MOSS EXPOSURE EXPERIMENT
in the vicinity of
NORTHERN WOOD PRESERVERS INCORPORATED
and
CANADIAN NATIONAL RAILWAY ORE DOCK
THUNDER BAY
1981

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ONTARIO MINISTRY OF THE ENVIRONMENT

August, 1983

INTRODUCTION

Northern Wood Preservers Incorporated operates a sawmill and wood preservation plant on the shore of Thunder Bay harbour. Annual production capacity is 177,000 cubic metres (m^3) of construction grade lumber and 142,000 m^3 of treated lumber (railway ties, hydro poles and construction lumber). Canadian National Railways (CNR) operates a shipping dock in the same area, where potash and iron ore are loaded into ships for transport to eastern ports. Pentachlorophenol, creosote, potash, and iron ore dust are potential air contaminants in this area. At the request of the Industrial Abatement Section of the Ministry's Thunder Bay District Office, a preliminary air quality study was carried out to measure the levels of these pollutants. Since these substances were in the form of particulate matter and volatile organic hydrocarbons, we decided to obtain our data by a moss exposure experiment. This work was conducted during the summer of 1981.

Periodic black smoke and odour emissions from Northern Wood Preservers are a source of complaints from area residents. An assessment of these emissions was not part of the study reported here.

METHODS

Mosses are effective substrates for absorbing and retaining many types of airborne contaminants. Techniques have been developed to suspend small quantities of moss in open-mesh bags to monitor the atmospheric environment (1,2). Samples of Sphagnum moss were exposed at 15 sites from June 5 to July 14, 1981 (Figure 1) using standard Ministry techniques (3). After an exposure period of approximately 39 days, samples were retrieved and analysed for chloride, iron, potassium and sodium at the Ministry's laboratories in Thunder Bay and Toronto. Potassium

and sodium were selected as tracers of potash and iron as a tracer for iron ore. Analysis of chloride was used as a tracer for pentachlorophenol and potash.

Vegetation near each sampling site was also examined for visible evidence of stresses caused by diseases, insects, contaminants, or physiological factors.

RESULTS

Vegetation in the study area was free of visible disease problems and air pollution damage. Severe defoliation caused by eastern forest tent caterpillars was noted on trembling aspen trees in a small area near site 13, below the trestle of the CNR ore dock.

Moss analysis results are presented in Table 1. Levels of chloride, iron, potassium and sodium were moderately above background concentrations on Northern Wood Preservers' property and near the CNR ore dock and trestle. A few values were significantly above normal. However, because most moss bags exposed in these areas were coated with a fine layer of light-brown particulate matter, we suspect that many elevated readings could at least partly be attributed to dust from unpaved roads and, possibly, from traffic on rail spur lines. Highest levels of iron occurred near roads and rail lines. In contrast to iron, potassium and sodium were highest near the CNR ore dock and trestle, and declined rapidly as distance from this area increased (Figure 2). This difference is probably due to different shipping schedules: during the exposure period, about 200,000 tons of potash were shipped, but no iron ore. Elevated concentrations of chloride were found at sites 1, 2, 3, 4, 8, and 10, all on Northern Wood Preservers' property, but there was no apparent distribution pattern. Potash in rail shipments and pentachlorophenol emissions from Northern Wood Preservers may both have contributed to elevated chloride in moss.

CONCLUSIONS

The moss exposure study carried out near Northern Wood Preservers Incorporated and the Canadian National Railway ore dock in 1981 showed that chloride, iron, potassium and sodium were occasionally elevated on company property. Dust from vehicular traffic may have contributed to iron concentrations found in moss, while potash transhipment at the ore dock probably accounted for elevated potassium and sodium. Elevated chloride found at some sites may have been due to windblown potash or to preservative emissions from Northern Wood Preservers.

There is no indication from this survey that the contaminants studied pose a significant environmental hazard. Elevated readings were confined to the immediate vicinity of the two industries investigated. Low levels would be expected in the nearest residential areas, several hundred metres to the west. No adverse effects on soils and vegetation would be anticipated. Beyond the current Control Order issued to Northern Wood Preservers, which requires abatement of emissions of airborne particulate matter, the results do not point to a need for further abatement action at this time.

REFERENCES

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3. Ontario Ministry of the Environment. 1983. Field investigation procedures manual. Phytotoxicology Section, Air Resources Branch.

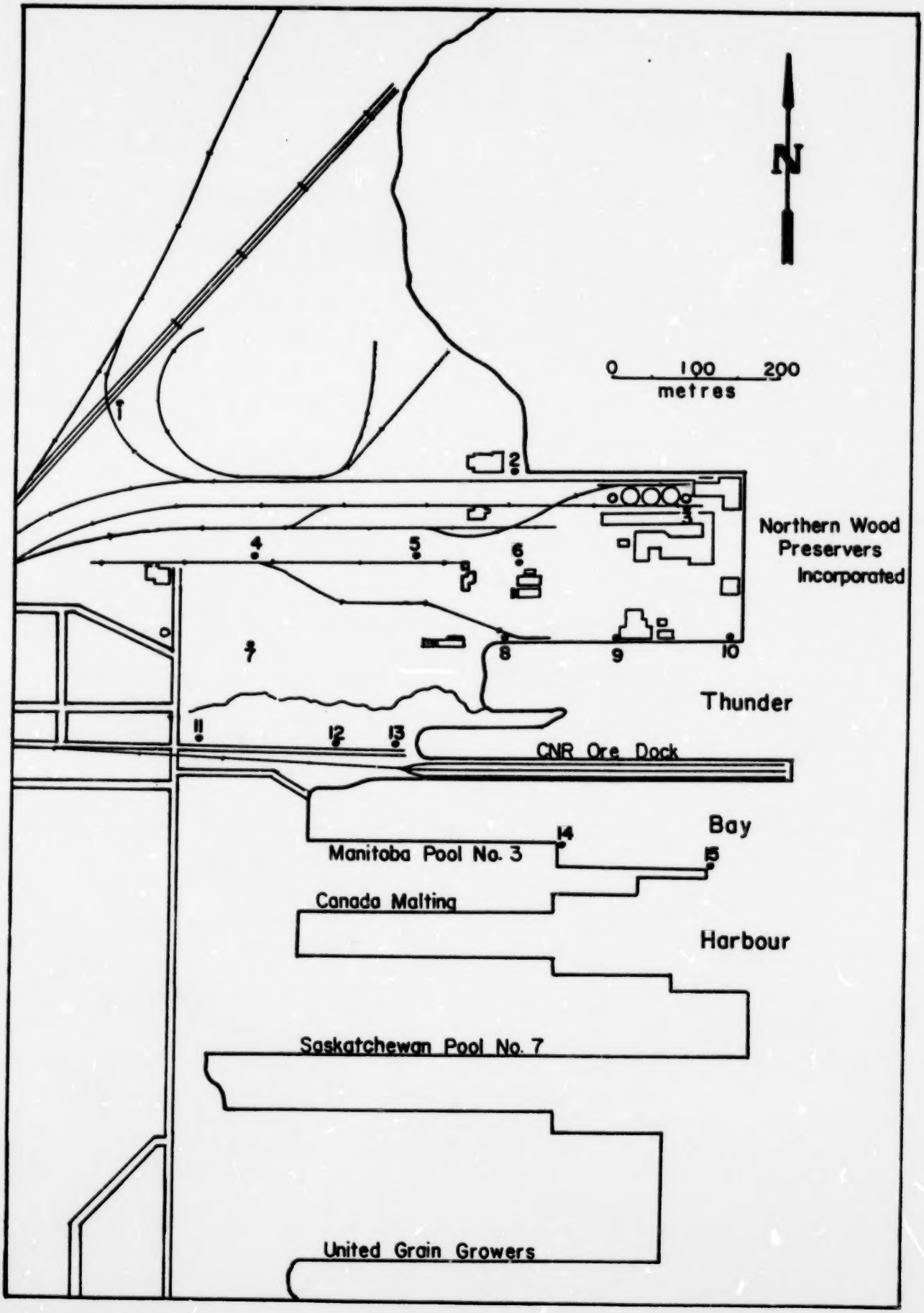

Figure 1. Moss bag exposure sites, June, 1981.

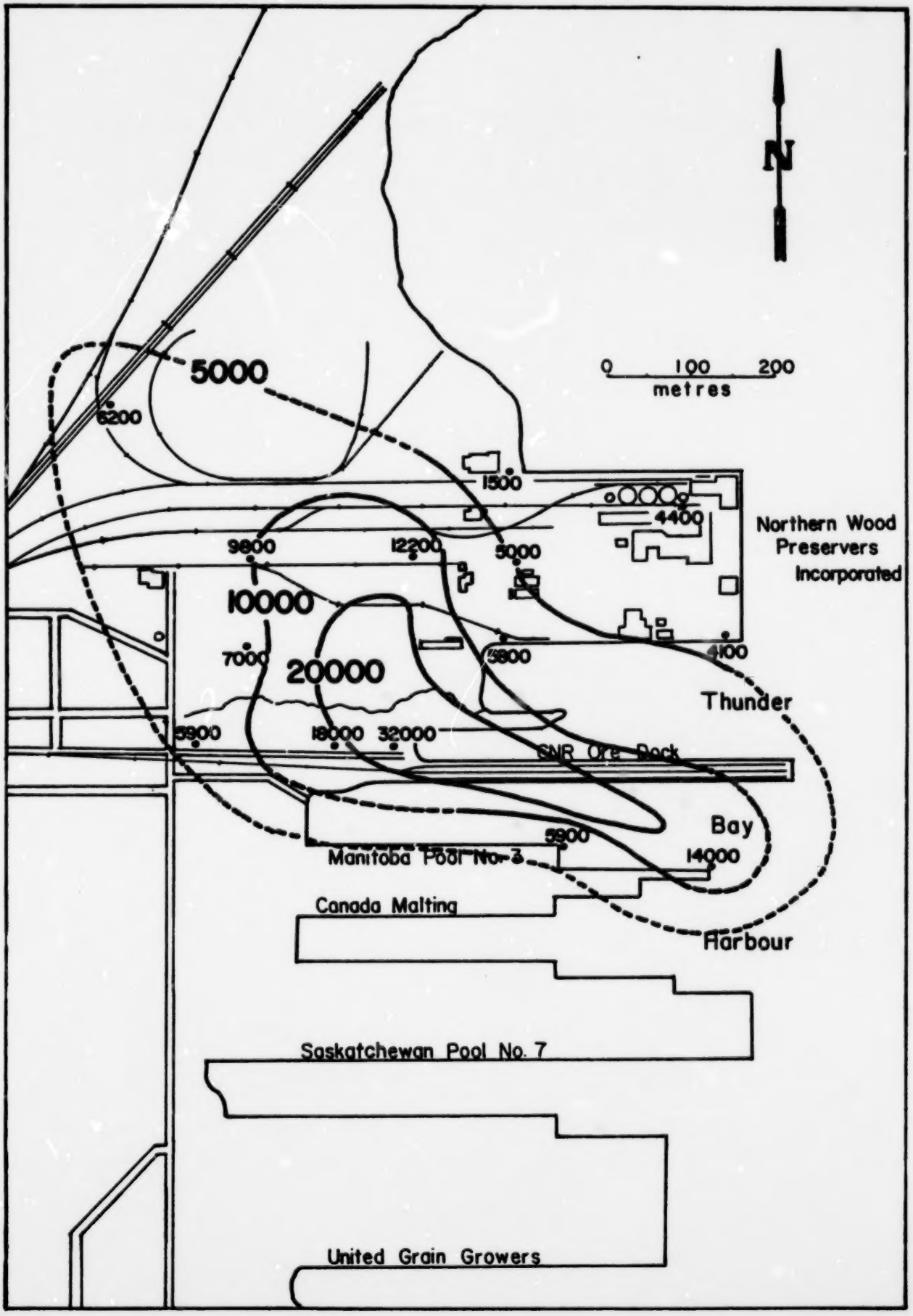

Figure 2. Levels of potassium (µg/g, dry weight) in exposed moss, Thunder Bay, 1981.

TABLE 1. Levels of chloride, iron and potassium (all as %, dry weight), and sodium (in µg/g, dry weight) in moss in the vicinity of Northern Wood Preservers Incorporated and the Canadian National Railway Ore Dock, June, 1981.

Site[a]	Chloride	Iron	Potassium	Sodium
1	1.40	0.19	0.62	370
2	0.90	0.37	0.15	110
3	0.70	0.21	0.44	230
4	0.90	1.30	0.98	440
5	0.10	1.10	1.20	630
6	0.04	0.62	0.50	320
7	0.05	0.45	0.70	410
8	0.90	0.32	0.58	330
10	1.40	0.18	0.41	200
11	0.13	0.52	0.59	350
12	0.39	0.46	1.80	860
13	c	0.38	3.20	1500
14	c	0.15	0.59	310
15	0.23	0.12	1.40	530
Exposed controls[b]	0.04	0.14	0.50	170
Unexposed controls[b]	0.03	0.13	0.42	150

[a]Moss bag at station 9 was lost in the field.

[b]Average of 27 values for chloride, 20 for iron, 2 for potassium, and 32 for sodium, from surveys conducted between 1976 and 1981.

[c]Insufficient sample.

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